

Electronic Medical Records and Electronic Health Records

Introduction:

In 2006, when Nevada Representative Jon Porter introduced legislation to revamp the Federal Employees Health Benefits Program to include an electronic health information system, healthcare reform and the nation's economy were not at the forefront of public policy agendas. In the three years since the legislation was considered, the political and economic landscape has drastically changed. Changes at the executive branch with the election of Barack Obama, along with Democratic majorities in the House and Senate, is similar to the realignment forces that were present in the early 1990s when the Clinton administration attempted healthcare reform and in 1965 when Medicare and Medicaid were passed. In contrast, a major economic difference compared to when past measures were considered is that healthcare expenditures have increased from 5% to 16% of the GDP, and at same time the number of uninsured has climbed to above 25%. This equals the 1965 value when Medicare and Medicaid were configured to solve the problem of the uninsured. The Baby Boom Medicare "explosion" is quickly approaching, certain to further strain healthcare resources, and an economic recession has focused political and business leaders on cost-containment measures, including healthcare expenditures. Accordingly, these forces are poised to redirect the typical incrementalism of health policy formation to more radical reformations.

This analysis was undertaken to evaluate the universal adoption of an electronic health record. Specifically, the existing electronic health information technology's

benefits and drawbacks along with its use in data mining to improve patient care are examined in the context of its adequacy for a national electronic health record (EHR) initiative. However, the prospects of a national electronic health record have not been uniformly received with enthusiasm. Perspectives of electronic health information systems have ranged from a bothersome burden to a healthcare panacea. While many in the insurance industry and academia have lauded its potential value, healthcare providers including physicians and hospitals have remained suspect of its cost-benefit ratio. These barriers to the implementation of an electronic health records are further considered below, along with the potential advantages and disadvantages its global adoption. Finally, the financing of such a project, either through the private sector or government sponsorship, is evaluated.

Defining an Electronic Health Record

The terms EMR (electronic medical record), EHR (Electronic Health Record) and PHR (Personal Health Record) are often used interchangeably by the media and health professionals. However, there are important distinctions to be made beyond mere semantics. EMR's are electronic databases of patient information containing many variables including demographic, medical and financial data. These systems are frequently linked to enterprise systems to coordinate billing and scheduling, in addition to non-patient care tasks such as marketing. This is in distinction to a PHR that contains individual patient information. These data can be in any form. EMR's and

PHR's can be merged, edited and retrieved in an electronic format and more broadly considered as an EHR.

The electronic health record (EHR) is traditionally a provider-controlled document. Managed care organizations and other payers can access EHR information to create standards for pay for performance programs for physicians and hospitals. Optimally, EHR data could be utilized in aggregate to develop improved standards of care, perform large epidemiological studies, and facilitate identification of patients exposed to a drug or device that has been recalled. Clinically, care provider to care provider transfer of information should be enhanced by an EHR. Improvements in documentation may optimize patient care, which arguably may reduce costs, improve collections. The extent of realization of these gains is not known.

As mentioned, above, the EHR may be comprised of individual PHR's. Traditionally, the personal health record (PHR) is patient-driven documentation. These systems are typically very user friendly, and are an important way for information to be passed between patients and providers. Many of the currently available PHRs offer additional benefits such as links to health newsletters and health encyclopedias. Most of the PHRs that were reviewed offer two to three levels of security and can include other personal information such as next of kin, insurance information, living wills, and emergency contacts. The PHRs are secure with username and password; there are restrictions regarding who can enter data, with this data being encrypted. These PHRs are made portable by using USB memory devices; some are accessed in a read-only manner for emergency services personnel. A few of the PHRs offered are free, but

many are available at a very low cost. Well established internet companies such as Google and Microsoft are offering free online PHRs. As with the other PHRs, it is patient controlled data and access is controlled and the information is securely stored.

Disadvantages to the various PHRs stem from the design of the PHRs themselves. Since the information is entered and edited by the patient, there may be inaccuracies in health assessment. A patient could omit entire sections of his health record, even if it is vitally important to his overall care. The elderly population, who may not be as computer literate, may not utilize a PHR at all. Another important limitation is the security of the information.

To facilitate portability, many PHRs offer ID cards for healthcare providers to obtain access to the patient's data. For example, the site <http://www.medsfile.com> allows printout of the record with no personal identifiers, which adds to security and assists emergency personnel. However, a lost card can potentially give anyone access to the information. Also, end user failure to guard the information safely would allow unauthorized access to patient documentation, and could lead to identity theft. The numerous cases of laptops being lost containing critical personal information underscore this point. In consideration of portability, compatibility must be considered. If different databases do not afford for electronic interchange of data, the benefits of a phr are lost.

A universal patient health records system implies a single medical document accessible by all of the patient's authorized healthcare providers. Secondly, a patient health record system (whether universal or not) specifically incorporates the input of

patients in addition to the input of healthcare providers. One of the major criticisms of the existing healthcare system is that information exists in “silos”. The analogy aptly describes the situation where each patient’s healthcare providers utilize an independent and separate health record. Within a single institution or healthcare provider group, multiple healthcare providers may be able to access the same record. When healthcare extends beyond these boundaries however, multiple duplicated health care records are created, resulting in the existence at any one time of multiple variably incomplete and semi-duplicated patient documents. The result is that healthcare, like the documentation which records it, ends up being fragmented and incomplete.

The increasing use of electronic documentation requires electronic storage. Onsite servers with backup redundancy are one answer while large terabyte repositories (with backup offsite storage) are another. There remains the possibility of server failure interrupting access to the EHR. Upgrading or changing software can leave an EHR unavailable unless an expensive data conversion is done. Many EHR programs are very expensive for small private practice offices. The cost impediment will slow acceptance of the project. Government financial support is being considered to advance the institution of office EHRs.

When considering these factors together it becomes apparent that a universal EHR and/or universally compatible EHR project should be considered. An important consideration regarding this undertaking is that stakeholders - individuals, clinical practice groups, agencies and political parties – may have non-congruent goals as they

consider what technology, infrastructure, support is needed to achieve implementation of such an EHR.

What might an EHR do?

The ultimate potential of a universal EHR is not known. Advocates contend it has the capacity to improve patient care, research and public policy formation. However, the cost-benefit ratio and privacy concerns have yet be resolved. Though specific goals are innumerable, the generable objectives of healthcare information systems would be to:

- improve quality
- reduce cost

In the short term quality improvement, monitoring and maintenance may add to costs. However, it is the response to these quality control outcomes that should decrease costs. Opponents contend that there is no definitive concrete evidence that EHR's improve healthcare, safety or decrease costs. They point to high EMR failure rates, implementation costs and low satisfactions rates. It is important to note that these, in general, have been experiences of enterprise EMR systems, not EHRs. Also, these experiences did not include data integration and intersystem sharing. Without this, the true safety and cost saving measures of an EHR are indeterminable. Additionally, both advocates and opponents agree that privacy must be an essential component to any system, and these details have not been agreed upon.

In order to be effective, an EHR must have data retrieval and manipulation characteristics over mere archival capabilities. Fortunately, the capabilities of existing EHRs' data mining (the process of locating and extracting information from a database; this data can be utilized in many different ways) functionality are established. The extent to which this data can or should be utilized is, however, still debated because the quality of research and public policy decisions will be proportional to the data and the manner in which they are stored. If erroneous data are input, suspect conclusions may be accepted as fact. In a universal system, this could have far reaching consequences in an environment with little checks and balances.

In the case of an electronic health record (EHR), these data typically pertain to protected health information, which is the focus of HIPAA regulations. When adequate safeguards are employed to protect the confidentiality of this information, it can provide researchers, policy makers and educators with extremely useful data. This information, or even access to the database, can also be misused with potentially serious adverse outcomes.

Like performing a search of the internet, choosing the correct terms or measures to perform data mining are critically important. In an EHR, there are hundreds of measures that are available to include in a search. Demographic data, such as age, gender, location, health insurance, or assigned provider can generate a useful denominator. The data can be searched by diagnosis, a specific medication or laboratory result, or other similar outcomes. Time is also a variable that can be included

in the data search. Including time allows the interested party to identify and track trends in the data.

There are innumerable “trends” that data mining yields. Simple measures, such as weight or blood pressure, can help identify populations at risk for other comorbid conditions. More complex studies can track the onset of a diagnosis, the subsequent treatments, as well as the degree of their success in controlling the condition. The prescribing patterns of healthcare providers, particularly when it comes to trends in utilization of generic vs. branded medications, could prove useful in analyzing the escalating costs of healthcare. Public health and consumer safety is also served by data mining. A medication recall, as discussed above, is easily facilitated by having an EHR and using common data mining techniques to identify any patient that has had that drug prescribed. A target population for a specific intervention, such as an immunization, is also readily obtainable from an EHR.

The potential of abuse in data mining is a real and significant threat to the integrity of such a program. If personal health information becomes accessible to the wrong person, confidential information might fall into the wrong hands. Like any statistical measure, an incorrect assessment might lead to a faulty conclusion and hence a misappropriation of efforts, funding, or educational intent. In this case, it is not the technology or design of the data mining system that is in question, but the integrity of the person(s) involved in the process that could generate the error. Compliance and integrity are paramount characteristics to consider in this type of program.

How will a project of this magnitude be funded?

The potential value of EHR to the healthcare industry at large as well as individual's health care is significant only if it becomes widely adopted by both individuals and healthcare providers. Additionally, the platforms must be secure and rapidly accessible and interoperable across different locations globally. Developing and implementing this technology on a widespread basis will take significant information technology expertise, innovation, and will have substantial costs. This leads to the question: How should the development and management of EHR be funded? Should the government subsidize this endeavor with taxpayer dollars? Should EHR be a for-profit endeavor?

The private sector presently funds the majority of EHR initiatives, but federal funding/incentives have been provided. For example, Kaiser has spent billions of dollars to develop and implement its EMR. The federal government has encouraged electronic transitioning among practitioners and hospitals. Federal electronic health "promotions" include bonuses for e-prescribing and filing under the auspices of pay for performance. However, the actual total amount of federal funding is unknown but it is certainly confined by existing budget deficits and competing priorities. President Obama's pledge to spend \$10 billion per year to create and implement a universal EHR may fall short and others sources of funding are likely to be required. Additionally, "government" administered programs may carry the stigma of lack of efficiency and innovation, and not being as responsive to the user as those developed by the private sector.

Despite the potential value to stakeholders, it is likely that additional personal and business taxes to fund this project would be met with substantial opposition. Also, the use of taxpayer dollars may not be the most efficient way to rapidly establish a widely accepted EHR system that transforms the way healthcare is practiced. As long as healthcare is part of a market driven economy, market based (as opposed to tax-based) solutions are most likely. The entrepreneurial spirit present in the private sector should be leveraged to quickly innovate, develop, and institute a safe, secure, user-friendly EHR platform that can be accessed by individuals and institutions globally. These will include the networks of public, private and not-for-profit companies combining resources and expertise to gain large market shares. Competitions for prize money for developing or grants to develop the best EHR platform with regard to security (meeting government established guidelines), user friendliness, reliability, and ability to integrate with existing EMR systems may be one way to encourage innovation from IT experts.

What is the ideal EHR?

The ideal EHR would meet the needs of all stakeholders. In the case of EHR's the sheer number of stakeholders makes the development of a universally accepted system difficult. A federal solution is unlikely in the present market base healthcare system. Market forces will likely select the "best" EHR's in terms of utilization, but the developers' interests may be divergent from other stakeholders.

It appears that a secure, affordable, compatible, transferable, user-friendly, universally accepted EHR's is years away. However, its "season" has come, despite

not knowing what the final fruits of the season will be. Hopefully, a market solution will be created before a multibillion dollar EHR tax-payer funded bailout is mandated.

Annotated Bibliography

<http://engineers.ihs.com/news/2006/aiim-astm-ehealth.html> is an engineering standards website. This 2006 article talks about a novel **.pdf/h** platform for electronic health records. The .pdf format will accept all types of medical information including images, text and graphics. The working group included the AAFP as well as Intel and Adobe and several others to create a “best practices” guide to facilitate the capture of data and make it secure. Its portability can be done with USB memory sticks. It will give patients more control over their health information. There is a list of associated ehr standards accompanying the article covering formatting, nomenclature, and other necessary standards.

<http://www.healthvault.com> is a personal health record created by Microsoft no longer in beta testing. It offers https encryption as well as SSL secure transmission of information. The healthvault can be used to set up single or family accounts, using the Windows Live username and password. Sharing the information with others is by invitation only except for healthcare professionals or for legal purposes. The program allows links to other programs that can be used for personal health programs. Control of the data is personal but at different levels. Anyone with ‘custodian’ level access is able to alter and/or delete all information. That person can also exclude the original custodian from access, a dangerous situation. Microsoft adequately warns in its privacy statement about this possibility. Many of the linked programs are phrs, and others are

information sites such as the Mayo Clinic Health Manager. The entering and editing of data is tedious in HealthVault due to the manual nature of entry. This could be a negative factor for the elderly. The HealthVault website will lock you out if there is no activity for twenty minutes, and unsaved data is lost when you reenter the site. The Mayo Clinic Health Manager is one of the linked programs and is a better interface. It works in conjunction with Healthvault very well and has several trackers to follow weight, BMI, Cholesterol levels, etc. Its editing function is better than that of HealthVault. Overall, HealthVault is a good phr site, and its partnering links are very useful.

<http://www.pdhi.com>, the website for ConXus Health Improvement platform, under the name of PDHI, *protocol driven healthcare, Inc.* ConXus has several tools to be used for health risk assessments that its clients can access. A phr is part of the module but the product is aimed toward employers, health plans and hospitals for their members. While it can interface with a member's emr, it does not seem to be either a true phr or emr/ehr. The data storage site is very tightly protected with guards, alarm doors, and other protections for the data storage. This option is central web based data management. A key feature is third party data importation/exportation. Its stated market is health plans, hospitals, brokers and health improvement companies.

<https://www.google.com/accounts/ServiceLogin?service=health> is a service of Google health. It is similar to the Healthvault service with several linked associated services and an ability for the user to control the health information. The site allows the user to build a health profile and track changes. Google offers links to online health-

related educational material. The service does allow HIPAA partner linking to other holders of the user's health information, such as a personal physician or pharmacy. That data can be linked to the Googlehealth account. Access is through a Google username and password, offering security. The privacy policy does not allow sharing of personal health information. Google does collect aggregate data for some purposes but it is never personally identifiable. A partial "health history" can be viewed by physicians. Google allows the user full control of the information including deleting all information found in the account. The service is free. To evaluate the site, a "health profile" was created. A component of this site is a shell repository for basic, personal medical information. There are links to find a doctor and import medical records. This appears to be an electronic phr (personal health record) site. However, its partners include notable hospitals, clinics, pharmacies and healthcare provider rating services.

<http://www.ihealthrecord.org> is now part of Medem. The backbone of the site is a series of checkoff options that are then added to a phr that can be placed on a wallet card. Access to the information can be granted to others, including personal physicians. While the site is easy to access and the entry of personal information is easy, the checkbox system is limiting in the options to check. I found the immunization module to be outdated. Some procedures, such as MRIs are found in the surgery module, which might confuse older patients. The site does allow printing of the full phr or just the wallet card. There is a patient library that can be accessed as well as a message center that will deliver information on programs that interest the patient. The ihealth record is secure and email addresses are not divulged to anyone. The privacy policy protects personal information. Linked sites are not protected by the Medem privacy policy, a

standard disclaimer. The privacy policy is written in an easy to read font and is only one short page long. I found no statement regarding security of the personal information, such as encryption of the data. As a phr and to create a wallet card it looks very adequate. As a full phr it needs improvement.

<https://secure.er-idcard.com/> is ER-id, portable phr, editable only by the owner, but with a name and member number, can be accessed by a professional. It appears that the information is kept at er-id and communicated to a provider over the Net. It gives a good measure of portability to the health record, but editing is up to the patient who is the only one who can open the file to write to. Membership is \$30/yr single, max \$84/yr for very large families. Good security and portability.

<http://www.onlinehealthrecords.com/> myphr.ca is a Canadian site. It proudly proclaims privacy as No. 1 priority. The website itself is not well created and the links alluded to are nonexistent. It has a lot in common with er-id cards. It too is self edited by the patient or his representative. What about the internet illiterate? This personal hr does two good things: it logs anyone who accesses the information and which information was examined. It claims to organize everything in one site. Membership is free. I asked the company a few questions about myphr.ca. After contacting the company here are some of the responses:

1. MyPHR.ca is not just for Canadians. In fact, because our company and servers are situated in Canada our customers' information is not subject to the US patriot act.

2. Yes, health professionals can have their own emergency login to see members' profiles without the member's username and password. All the health professional and emergency responders have to do is create an account and request a health professional login (and once verified as such) they can login and then enter a member's 12 digit number to see a "read-only" profile of a member's health information.

You can have all of your patients create an account for free (and have them enter their information online) and then you can see their information online at ***www.myPHR.ca*** or mobile device (such as a Blackberry/Palm) at ***www.myPHR.ca/mobile*** 24/7 where ever you are!

http://www.aetna.com/news/2006/pr_20061003.htm is a phr developed by Aetna. Most of the information is filled in automatically by Care Engine, which is actually a relational database that searches claims records and pharmacy fills. There is an area where the patient can enter and update other items. Its portability is that it can be printed out to give to physicians. Physicians also have access to the data. Its strength is in its database capabilities to automatically access information and update the phr. Aetna will send alerts to the patient and physician regarding cross reactions, medications to refill, and tests/exams that need to be done. These are some very nice features. Security features are password encoded. It is web based for access. Its weakness is that it is linked to the insurance company. If your employer changes policies, can you still access the data and give it to your physician. If not, at that point the information becomes static and out of date and it decreases in value unless Aetna

sets it up independently of its insurance function and allows anyone to purchase and use it. But then how does Care Engine access the claims data. STD, HIV, and family planning information are not automatically entered and must be entered by the patient. There are more questions from my initial review than answers. Question on alternate (non primary) provider access to the information—the ER or out of town visit (snowbird phenomenon). Their data will enter the system via claims, but how do these providers access the information in emergency situations. How do you correct a misdiagnosis?

[Soarian® Enterprise Document Management](#) by Siemens is more than just an ehr product but rather a complete practice management and “computer aided diagnosis” package. It has several modules that you can add for more complete management but our quest is to identify how to make ehr and the phi portable and private. The setup looks very expensive, a barrier for small practices and individuals. The Soarian portal allows for online access by providers. There is little information about the personal health record, but the EMR, called the online medical record, appears to be very strong. We are looking for nationwide access to phr that can help in patient care. The website only indicates that Siemens will assist you in building a phr.

[<http://www.allscripts.com/products/electronic-health-record/default.asp>](http://www.allscripts.com/products/electronic-health-record/default.asp) Allscripts had partnered with Microsoft in 2006 to develop EHRs. It has since branched out forming other IT and content provider partnerships. To date it has 150,000 physician participants. Its focus includes business and office management as opposed PHRs, alone.

<http://www.indcaremgmt.com/onlinepersonalhealthrecord.htm>. is a case management site and can't be accessed unless you have a member id. From the webpage it looks like they do case management for employers, etc. and offer to customers a personal health record. I could not look at the form of the record itself or how it keeps things secure.

<http://www.healthrecordsonline.com/> This site, Canadian based, offers secure servers to store one's medical information. All data is sent encrypted, and there is a three-step security system to ensure no one can have access to your records except you. Access is via the internet. It appears that the patient adds/updates the information, so it could be biased or susceptible to errors. There is a section for physician notes to be added, but the patient has the ability to delete entries at his or her discretion. It costs \$44 per year (Canadian dollars) for this service. I think it would be great to have if one does a lot of travel, but would not be optimal from a physician's perspective to replace the patient's original chart, whether paper or electronic.

<http://www.accessmyrecords.com/index.htm>. Another site where personal health information, entered by the patient, is stored and that is accessed via the web. The patient carries a card with his ID number on it and this will allow anyone to access the record; there is encryption but no super-secret password. The data can also be accessed on a cell phone, if that is the only system available to the emergency responder. It is \$30 annually, \$50 for a couple and only \$20 per child. Very affordable, and would appeal to travelers, but access is possible by anyone who obtains your ID card, so is less secure. The entry of data is 100% controlled by the patient as well;

there is no option for a physician to add entries unless the patient scans records into his or her MyAccess chart.

<http://www.chartaccess.com/html/services.html>. This site is an online service to request copies of medical records, and then view/retrieve them via the internet. They make a big push about customer service, promptness and accessibility in particular, towards the requesting entity. Their primary service is attending physician statements for the insurance industry. The request is made on-line, and frequent status reports of the request are available. Fees are not disclosed for this service. One advantage is that the entire process, including viewing the records, can be handled in a paperless method and is very customizable.

<http://www.ehealthglobaltech.com/> Another provider of records retrieval services, like chart access. The site is as much an advertisement about the company, with press releases and financial reports, as a portal to obtain medical records in a completely electronic format. They do have a global network with several more specialized subsidiaries, which include research and digital radiographic images. The company appears well organized and has a whole section where all the various stakeholders in Health Information Management are able to see where ehealth will interact and likely benefit them. The website is exhaustive; they seem to have thought of everything. Despite this impression, one cannot find out the fees for this service unless you make direct contact with a customer service representative.

<http://www.medfusion.net>. This company develops secure patient-physician communication systems which provide many levels of service. From requesting

appointments to facilitating doctor-patient communication, mass e-mailings to patients, as well as individualized messages. The service includes training of client office staff and broad technical support. Patients can use this product to complete forms and pay bills online, request prescription refills, and communicate with the office staff directly. There is also a medical record that is “partially” controlled by the patient, but the specifics are omitted. It is difficult to determine the cost of the product without making contact with a sales representative, but like many of these EMR-related sites, there is a ROI calculator which likely can demonstrate a positive yield using medfusion’s numbers. They offer many other services not at all related to an EMR, such as helping develop an intranet or webpage for the healthcare provide

<http://www.amazingcharts.com/company/companyframeset.html>. This physician developed EHR has been implemented into 2000 offices. Its benefits include chart and schedule integration with low licensing fees (\$995). I was able to download a trial version of the program. It is quite easy to use, but its lack of sophistication would make add-ons (X-rays, EKG’s, Labs, etc) difficult.

<http://www.cchit.org> Certification Commission for Healthcare Information Technology. This nonprofit organization has the goal to “accelerate the adoption of health information technology by creating an efficient, credible and sustainable certification program.”

Site includes a list of CCHIT certified ambulatory, inpatient, emergency and information transfer EHR providers and information of certification requirements. The

mere existence of this site points to some of the challenges facing EMRs developed in the private sector.

http://www.gehealthcare.com/user/hit/products/centricity_practice/emr_index.html.

GE Centricity GE offers personal use and enterprise software. Potential advantages include data integration (GE media platforms are available) and web/network based portals. Operational benefits include data mining programs for business units which are optional.

<http://www.nextgen.com>. This product appears to be very similar to the Centricity system, but more end user focused. I tried out the online Demo and previewed the version for our institution. It will likely require the use of a scribe to allow efficient use that does not interrupt the typical human interface between patient and physician.

<http://www.practicepartner.com>. McKesson Practice Partner. McKesson recently acquired Practice Partner which was originally founded in 1983 as Physician Micro Systems. Its focus is integration of appointments, scheduling and patient information with billing features. McKesson is already a major force in healthcare operations and has partnered with Oracle, Citrix and Microsoft (SQL Server).

<http://www.webmd.com>. is the WebMD site. To better evaluate this feature I completed the two minute registration. It is a basic PHR platform with health assessment and information sharing options. A weakness includes the lack of data importation.

<http://www.iom.edu>. Institute of Medicine. This influential health policy institute's website contains a number of reports advocating the use of electronic medical records to improve patient quality. Specifically addressed are the potential uses of data mining to monitor diseases, treatments and trends.

<http://www.kaiseredu.org>. The Henry J. Kaiser Foundation. The Kaiser foundation has summaries of health information technologies and links to related sites. Particularly useful is its breakdown of electronic health records and associated costs.

<https://www.kaiserpermanente.org>. Kaiser Permanente, the nation's largest HMO/insurer offers on its site "My Health Manager" and "My Medical Record" features that are extensions of its ambitious EMR project.

<http://www.healthcareitnews.com>. Healthcare IT News. This site covers the expanse of healthcare information technology. In particular news and evaluations of EMRs and PHRs are presented.

<http://www.revolutionhealth.com>. Revolution Health like Google, Microsoft and WebMD, this software offers a PHR option at no charge. It is similar in content and format to WebMD, but it offers less personal diagnostic and self help options.